6.7.2 Data Evaluation

Tables 6-12, 6-13, and 6-15 present a summary of the COPCs for quantitative risk assessment for Area A-1 surface soils/wetland material/sediments, "all soils" to a depth of 15 bgs, and surface waters, respectively. COPCs were identified based on a comparison of site data to the COPC screening levels defined in Section 6.2. All validated CLP data collected during recent and historical investigations, except soil data collected from depths greater than 15 feet, were used to identify COPCs. Soil data at depths greater than 15 feet were not used because human exposure to soils deeper than 15 feet bgs is considered very unlikely. Because of the significant correlation observed between field screening data and validated CLP data for lead and copper, screening data were also used for these chemicals at sample locations where no CLP data are available. An evaluation of groundwater is not part of the scope of work for this human health risk assessment, but will be addressed as part of an area-wide groundwater assessment to be provided as a separate document.

Table 6-14A and 6-14B compare maximum chemical concentrations detected in the surface soils, wetland material, and sediments data set and the "all soils" data set, respectively, to the groundwater protection benchmarks defined in Section 6.2.1.1 (the Generic SSLs for migration from soil to groundwater and State Pollutant mobility GB criteria). Although groundwater data were not addressed in this risk assessment, the comparison allows for a preliminary evaluation of the potential for chemicals to migrate to groundwater and potentially impact the quality of groundwater. Chemicals in excess of groundwater protection benchmarks, but not in excess of direct exposures criteria are not carried through the quantitative risk assessment (numerical risk estimates are not developed) because they are not considered to be significant contributors to the direct exposure pathways identified for potential human receptors.

A media-specific discussion of COPCs is presented in the following paragraphs.

6.7.2.1 COPCs for Soil/Wetland Material/Sediment

The COPC selection process for soil, wetland material, and sediment is summarized in Tables 6-12 and 6-13. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum site concentrations to risk-based COPC screening levels for residential land use; Generic SSLs for migration from soil to air, State RSRs, and maximum background concentrations (inorganics only):

- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene),
- Aroclors (1248, 1254, 1260, 1262, and 1268),
- PCB congeners,
- Metals (antimony, arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, thallium, vanadium, and zinc),
- Dioxins/Furans,
- Asbestos, and
- Aldrin.

Vinyl chloride was not accepted as a COPC due to the low frequency of detection and only a slight exceedance of the selection criteria. However, all Aroclors and PCB congeners were accepted as COPCs because at least one congener was detected at a maximum concentration exceeding COPC screening levels.

Benzo(k)fluoranthene and aldrin were selected as COPCs for the 0 to 15 feet bgs category only since the maximum concentrations of these chemicals in the surface soil samples

(from depths of 0 to 2 feet bgs) were less than the direct exposure COPC screening levels.

Maximum detections in soil, wetland material, and sediment were also compared to Generic SSLs for migration from soil to groundwater and Connecticut RSRs for pollutant mobility in a GB classified area. Maximum concentrations of the following chemicals exceeded the generic soil pollutant mobility criteria, indicating a potential for these chemicals to migrate to groundwater and potentially impact the quality of groundwater:

- VOCs (benzene, methylene chloride, trichloroethene, and vinyl chloride),
- SVOCs (3,3 dichlorobenzidine, bis(2-ethylhexyl)phthalate, carbazole, n-nitrosodiphenylamine and pentachlorophenol),
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene),
- Pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, alpha-BHC, alpha-chlordane, beta-BHC, delta-BHC, dieldrin, gamma-chlordane, and heptaclor epoxide), and
- Metals (arsenic, antimony, barium, cadmium, chromium, mercury, nickel, selenium, thallium, and zinc).

Maximum detections in soil, wetland material, and sediment of trichloroethene, n-nitrosodiphenylamine, arsenic, selenium, and zinc exceeded the groundwater protection benchmarks for the 0 to 15 feet bgs category only since the maximum concentrations of these chemicals in the surface soil samples (from depths of 0 to 2 feet bgs) were less than the Generic SSLs for migration from soil to groundwater and Connecticut RSRs for pollutant mobility in a GB classified area.

Under the Connecticut RSR guidance (CT DEP, January 1996), concerns regarding the mobility of inorganics are addressed using TCLP and/or SPLP data. A comparison of site-specific SPLP data to State RSRs for pollutant mobility is provided in Table 6-14C. Reported concentrations of several metals (primarily copper, lead, and manganese) in the SPLP extracts from several soil samples exceeded the State pollutant mobility criteria.

6.7.2.2 COPCs for Surface Water

Table 6-15 presents a summary of the COPC selection process for surface water. Based on a comparison of maximum site concentrations to risk-based COPC screening levels for tap water use and drinking water standards (federal and state MCLs), the following chemicals were identified as COPCs:

- VOCs (1,1,1-trichloroethane, 1,1-dichloroethene, 1,2-dichloroethene[total], benzene, bromodichloromethane, chlorobenzene, chloroform, tetrachloroethene, trichloroethene, and vinyl chloride),
- Pesticides (gamma-chlordane), and
- Metals (antimony, arsenic, and manganese).

Although surface water at the site is not currently used or expected to be used in the future as a drinking water supply, drinking water criteria (federal and state MCLs) were included for informational purposes and to conservatively identify COPCs for the site. The Connecticut State MCL for sodium is a state notification level and is not risk based. For this reason, sodium was not selected as a COPC, despite concentrations above the state MCL.

6.7.3 Area A-1, Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at Area A-1 and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 6.4. Site-specific information regarding exposure is provided in this section.

The potential for exposure at Area A-1 is based on several factors, including current and future land uses, activity patterns, site access controls, chemical behavior in the environment, and the presence of human receptors. Based on these variables, exposure scenarios were developed to characterize the potential for human exposure under both current and future site conditions. The future scenario accounts for likely or anticipated changes in land use and site characteristics that may alter exposure and/or concentrations of COPCs in a given medium.

The exposure assessment is based on the assumptions that, in general, chemical compositions for environmental media are identical under current and future site conditions. Under current conditions, potential human receptors (the frequent recreational user, trespasser, and commercial worker) are assumed to be exposed to surface soil and/or sediment (0 to 2 feet bgs). In the future, contaminated soils currently located at depth and/or beneath pavement to a maximum depth of 15 feet bgs may be brought to the surface during land development (excavation/construction). Under future conditions, commercial workers are evaluated for exposure to soils collected from depths of 0 to 15 feet bgs throughout Area A-1. With the exception of the receptors involved in commercial activities, similar soil/sediment exposure is likely for potential receptors under current and future conditions. Given that future changes to the chemical composition of the creek/marshy waters are difficult to predict, it is assumed for purposes of this risk assessment that chemical concentrations in surface water would not change in the future.

A summary of the potentially significant exposures identified for quantitative evaluation for Area A-1 is provided in Table 6-16.

6.7.3.1 Area A-1, Land Use and Site Access

Area A-1, Morgan Francis Property, is approximately 600 feet south of the Raymark Facility property, as shown in Figure 1-2. It encompasses a portion of Ferry Creek, which flows south from Interstate 95 to Ferry Boulevard; some commercial properties that EPA refers to as Salce Construction, Preferred Products, Shock's Autobody, and the Morgan Francis Property; and the State of Connecticut properties near Interstate 95 and the triangle-shaped parcel of land between Ferry Boulevard and East Broadway Street. The site covers approximately 11.1 acres including approximately 0.44 acres of wetlands (including the creek channel) and includes the upper portion of Ferry Creek. This portion of Ferry Creek bisects Area A-1, which is primarily used for commercial purposes. Although fence restrictions are located around portions of the commercial properties, access to Ferry Creek and the commercial properties is still possible. In addition, fencing may not limit access under future land use conditions.

Area A-1 is bounded by Interstate 95 to the north and northwest, residential properties along Blakeman Place to the west, Ferry Boulevard and East Broadway Street to the east and northeast, and residential properties along Harris Court to the south.

6.7.3.2 Area A-1, Potential Receptors

As identified in Section 6.4, several potential receptor populations were initially considered for inclusion in the exposure assessment. However, the majority of these receptors were eliminated from further evaluation based on the current land use, site access, COPCs, and the likelihood of exposure. Of the receptors initially considered (residents, recreational users, commercial workers, construction workers, and trespassers), the receptors retained for quantitative evaluation are frequent recreational users, commercial workers, and trespassers.

Portions of Area A-1 to which receptors are exposed are shown in Figure 6-1. As discussed in Section 6.4, the frequent recreational user is evaluated to estimate risks to individuals residing in close proximity to the Area A-1 site contamination. Possible exposures of nearby residents to site-related contaminants would be through recreational activities. Persons involved in recreational activities (the frequent recreational user) may visit the site, thereby coming in contact with potentially contaminated site media. These receptors are assumed to be exposed to soil in a limited area (soil within approximately 100 feet of the site boundary that abuts the residential area).

Area A-1 is primarily used for commercial purposes, however, adolescents may trespass onto the site. All areas of Area A-1 are assumed to be accessible to adolescent trespassers.

Possible exposures of commercial workers to site-related contaminants would be through commercial/industrial activities in Area A-1. These receptors are assumed to be exposed to soil in a limited area (soil within the immediate vicinity of commercial properties that EPA refers to as Salce Construction, Preferred Products, Shock's Autobody, and the Morgan Francis Property; and the State of Connecticut properties near Interstate 95 and the triangle-shaped parcel of land between Ferry Boulevard and East Broadway Street). No major construction projects are planned for Area A-1 or the surrounding areas. However, the baseline risk assessment was conducted assuming that the commercial worker may be exposed to soils as deep as 15 feet bgs in the future. Future commercial workers are assumed to be exposed to soils throughout Area A-1 (soil within the commercial properties extending to the boundaries of residential properties).

Future on-site residents were not included in the baseline risk assessment for Area A-1. Current land use suggests that the area is valuable as commercial property. Additionally, much of the soil in Area A-1 surrounding Ferry Creek is wetland material and local construction practices preclude subsurface excavation and/or development of Area A-1 for residential purposes. In addition, groundwater at the site is not used or expected to be used in the future as a potable water supply because of brackish conditions.

6.7.3.2.1 Recreational Users

Area A-1, Morgan Francis Property, is primarily commercial, however areas located near residences may be used for recreation by nearby residents. These frequent recreational users are evaluated for exposure to surficial soils (0 to 2 feet bgs) near the residential properties under current and future land use. The unattractive and intermittent nature of the creek in this area precludes significant exposures. Therefore, direct contact with sediments in the creek bed and wetland soils along the creek banks are not anticipated for these receptors. Recreational users are assumed to be exposed to site media frequently (150 days/year) due to the proximity of residential properties. These receptors are assumed to ingest an average of 200 mg/day for six years for the child and 100 mg/day for 24 years for the adult for the RME, and an average of 100 mg/day for two years for the child and 50 mg/day for seven years for the adult for the CTE. Face, hands, forearms, and lower legs are expected to be available for dermal contact for adults. For children, face, hands, forearms, lower legs, and feet are expected to be available for dermal contact.

6.7.3.2.2 Adolescent Trespassers

All areas of Area A-1 are accessible to adolescent trespassers (ages 9 to 18). These trespassers are evaluated for exposure to surficial (0 to 2 feet bgs) soils, wetland soils, and sediments in all of Area A-1 and surface water in Ferry Creek. These receptors are assumed to ingest an average of 50 mg/day for five years for the CTE and 100 mg/day for 10 years for the RME. Trespassing is assumed to occur at a frequency of one day/week throughout the year. Face, hands, forearms, and lower legs are expected to be available for dermal contact with soils/wetland soils/sediments. Hands, lower legs, and feet are expected to be available for dermal contact with surface waters.

6.7.3.2.3 Commercial Workers

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact. Under the current land use, commercial workers are evaluated for

exposure to currently exposed surficial soils (0 to 2 feet bgs) at the commercial properties only. In the future, contaminated soils currently located at depth and/or beneath pavement may be brought to the surface through excavation and land development. Commercial workers are evaluated for exposure to soils from throughout Area A-1 at 0 to 15 feet bgs under future land use. Workers are not expected to be exposed to contaminated soil, sediments, or surface water in the creek bed or along the banks of the creek. Commercial workers are assumed to be exposed to site media 250 days/year. These receptors are assumed to ingest an average of 50 mg/day for nine years for the CTE and 100 mg/day for 25 years for the RME. Hands, forearms, and lower legs are expected to be available for dermal contact with soils.

6.7.3.3 Area A-1, Exposure Pathways

The primary routes of exposure for potential human receptors at Area A-1 are incidental ingestion of and dermal contact with soil, sediment, and wetland soils, and dermal contact with surface water. Exposure routes associated with soil contact are evaluated for recreational users and commercial workers. Exposure routes associated with soil, sediment, and wetland soils, and surface water contact are evaluated for trespassers.

Other potential exposure routes such as groundwater uses, inhalation of fugitive dust and volatile emissions, and ingestion of surface water were not evaluated for the following reasons;

- The shallow aquifer at Area A-1 is not used as a potable water supply either at Area A-1 or in the surrounding areas. Shallow groundwater at the site discharges to Ferry Creek and its tributaries. Thus, domestic groundwater exposures by nearby residents are eliminated. In addition, as previously mentioned, groundwater at the site is not used or expected to be used in the future as a potable water supply because of brackish conditions and productivity constraints. It should be noted that groundwater quality at Ferry Creek is being investigated as a separate operable unit.

- Potential exposure to volatile emissions and fugitive dust from Area A-1 is considered to be minimal, thereby eliminating the need for quantitative evaluation of this exposure pathway. As shown in Tables 6-12 and 6-13 all reported surface and subsurface soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (US EPA, 1996a) with the exception of vinyl chloride and chromium. Vinyl chloride was not accepted as a COPC due to low frequency of detection and only a slight exceedance of the selection criteria. The SSL_{AIR} for chromium assumes that chromium is present in the hexavalent state. The assumption that all chromium is in the hexavalent state is overly conservative. Additionally, the average chromium concentration detected in the solid matrix samples (65 mg/kg) is less than the SSL_{AIR} (270 mg/kg).

- Potential exposure to contaminants in surface water from Area A-1 through incidental ingestion is considered to be minimal due to the limited nature of contact with surface water in this area.

6.7.3.4 Area A-1, Exposure Point Concentrations

Current EPA risk assessment guidance (EPA, 1992a and 1993d) was used to identify appropriate exposure point concentrations for CTE and RME conditions. Exposure point concentrations used in the risk assessment are presented in Table 6-17. For wetland soil, soil, sediment, and surface water, 95 percent UCLs of the arithmetic mean were used as exposure point concentrations in estimating chemical intakes for the RME and CTE. In data sets with 10 samples or less and data sets in which the calculated 95 percent UCL exceeded the maximum detected concentration, the maximum detected concentration was used as the exposure point concentration for the RME and the average concentration was used for the CTE case. Listings of sample locations included in the evaluation of each receptor group are included in Appendix F-5. Support documentation for the calculation of dioxin TEQ concentrations, 95 percent UCLs, and distributions of data sets for COPCs are presented in Appendix F-6.

6.7.3.5 Area A-1, Estimates of Chemical Intake

Estimates of chemical intake were calculated using equations presented in Section 6.4. Tables 6-10 and 6-11 contain the various assumptions used as input parameters to determine chemical intakes for each potential receptor and exposure route. Chemical intake estimates for Area A-1 are provided in the site-specific risk assessment spreadsheets contained in Appendix F-9.

6.7.4 Risk Characterization

A summary of the quantitative risk assessment for Area A-1, the Morgan Francis Property, is provided in this section. Total noncarcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk for the RME and CTE scenarios, are outlined in Table 6-18 for the frequent adult and child recreational user, the adolescent trespasser, and the commercial worker. Sample calculations are provided in Appendix F-8. Appendix F-9 contains the chemical specific risks for Area A-1.

6.7.4.1 Noncarcinogenic Risks

Hazard indices developed for the commercial worker, frequent adult and child recreational user, and the adolescent trespasser were as follows:

	RME Case	CTE Case
Commercial Worker (Current/Future)(Surface Soils)	4.7E-01	7.3E-02
Commercial Worker (Future) (All Soils - 0 to 15 ft)	2.1E-01	1.0E-01
Frequent Recreational User – Adult (Current/Future)(Surface Soils)	2.3E-01	2.8E-02
Frequent Recreational User – Child (Current/Future)(Surface Soils)	2.1E+00	2.6E-01
Adolescent Trespasser (Current/Future)(Surface Materials/ Surface Water)	8.8E-02	4.3E-02

Except for the frequent child recreational user under the RME scenario, all HIs are less than unity, indicating that adverse noncarcinogenic health effects are not anticipated under the

conditions established in the exposure assessment. Examination of target organ-specific hazard indices for the frequent child recreational user under the RME scenario reveals that none are at or greater than unity. Therefore, adverse noncarcinogenic effects are not anticipated for this receptor under the conditions established in the exposure assessment.

6.7.4.2 Carcinogenic Risks

Incremental cancer risk estimates for the commercial/industrial worker, frequent adult and child recreational user, and the adolescent trespasser were as follows:

	RME Case	CTE Case
Commercial Worker (Current/Future)(Surface Soils)	1.6E-03	9.2E-05
Commercial Worker (Future)(All soils - 0 to 15 ft)	1.7E-04	2.6E-05
Frequent Recreational User – Adult[1] Current/Future)(Surface Soils)	4.1E-05	1.7E-06
Frequent Recreational User – Child[1] Current/Future)(Surface Soils)	9.1E-05	4.5E-06
(Adolescent Trespasser (Current/Future)(Surface Materials/Surface Water)	5.6E-05	1.4E-05

(1) Summation of total risk for frequent recreational user (adult plus child): 1.3E-04 (RME case) and 6.2E-06 (CTE case).

The risk estimates for current/future commercial workers exposed to surface soils exceed the EPA target cancer risk range (1E-4 to 1E-6) and the CT DEP target risk level of 1E-5 when the RME case is evaluated. Risk estimates for future commercial workers and recreational users are at the high end of the EPA target risk range when the RME case is evaluated. The risk estimates for the adolescent trespasser are within the EPA target cancer risk range (1E-4 to 1E-6) when the RME case is evaluated, but exceed the CT DEP target risk level of 1E-5. For all receptors, risk estimates for the CTE case are within the EPA target cancer risk range (1E-4 to 1E-6), but cancer risks for the current/future and future commercial workers and the adolescent trespasser exceed 1E-5, the CT DEP target cancer risk level. As detailed on Table 6-18, PAH compounds (benzo(a)pyrene,

benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene), total Aroclors (PCBs), dioxin/furans, and arsenic are predominant risk drivers. RME cancer risk estimates for dioxins/furans (current and future) and total Aroclors (current) exceed 1E-4 when the commercial worker is evaluated.

6.7.4.3 Exposure to Lead

Lead was identified as a COPC in soils, wetland materials, and sediments at the Morgan Francis Property. Lead was detected at a maximum concentration of 25,600 mg/kg.

Exposure to lead in surface soil by the frequent child recreational user was evaluated using the EPA IEUBK Model, as discussed in Section 6.4.7. The IEUBK model was developed to evaluate exposures to lead by children in a residential setting. Consequently, using the IEUBK model for child recreational exposures should provide a very conservative evaluation of exposures to lead in soil. The exposure point concentration of 455 mg/kg (based on the average lead concentration) as well as several default parameters were used to estimate blood-lead levels for children in a residential setting. IEUBK Model outputs are included in Appendix F-12. The estimated geometric mean blood-lead level for children exposed to lead in site soil was 5.8 micrograms per deciliter (µg/dL), which is less than the established level of concern of 10 µg/dL. The IEUBK model estimates that 11.3 percent of children are expected to have blood-lead levels greater than 10 µg/dL, which exceeds the acceptable level of 5 percent.

Exposure to lead in surface soil by the frequent adult recreational user was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996b). The exposure point concentration of 455 mg/kg (based on the average lead concentration) for soil as well as several default parameters were used to estimate blood-lead levels for adults engaging in recreational activities. Under the RME scenario, the model estimated that the 95th percentile blood lead concentration among fetuses born to women having site exposures ranged from 6.15 µg/dL to 9.45 µg/dL and under the CTE scenario the 95th percentile blood lead concentration ranged from 5.09 µg/dL to 8.08 µg/dL, which are less than the established level of concern of 10 µg/dL.

Exposure to lead in soil by the commercial worker was evaluated by use of the slope-factor approach. The exposure point concentration of 1,050 mg/kg for surface soil under the current scenario and 745 mg/kg for "all soil" under the future scenario (average lead concentrations) as well as several default parameters were used to estimate blood-lead levels for workers in a commercial setting. Under the current surface soil RME exposure scenario, the model estimated that the 95th percentile blood lead concentration among fetuses born to women having site exposures ranged from 12.19 µg/dL to 17.24 µg/dL, which exceed the established level of concern of 10 µg/dL. Under the current surface soil CTE scenario, the model estimated that the 95th percentile blood lead concentration among fetuses born to women having site exposures ranged from 8.11 µg/dL to 11.97 µg/dL, which exceeds the established level of concern. Under the future "all soil" RME exposure scenario, the 95th percentile blood lead concentration ranged from 9.82 µg/dL to 14.18 µg/dL, which exceeds the established level of concern of 10 µg/dL. Under the future "all soil" CTE exposure scenario, the 95th percentile blood level concentration for fetuses ranged from 6.92 µg/dL to 10.45 µg/dL, which only slightly exceeds the level of concern.

6.7.4.4 Summary of "Hot Spot" Analysis of PCB and Lead Results Area A-1

Given the fact that Area A-1 covers approximately 11.1 acres, the data for two of the predominant COCs (lead and total Aroclors) were reviewed with the EPA to determine if contaminant "hot spots" exist within the study area. Three potential "hot spots" locations were identified, as shown in Figure 6-1. A hot spot evaluated for trespasser exposure is located within and along Ferry Creek. A hot spot evaluated for recreation exposure is located in the vicinity of residences. A hot spot evaluated for commercial exposure is located within the commercial area near Ferry Creek. Sample lists for Area A-1 hot spots are included in Appendix F-5. Because of the reduced size of hot spots relative to the entire study area, exposure frequencies were set at 90 days per year for all hot spot evaluations. The RME and CTE EPCs for total Aroclors and lead in the "hot spots" are presented in the following table and compared to the EPCs presented in Table 6-17 (the EPCs from Table 6-17 are presented in *italics*);

Exposure Area	Total Aroclors (µg/kg) RME/CTE	Lead EPC Concentration (mg/kg) RME/CTE
Trespasser Hot Spot	12,000/3,400 *(10,000/10,000)*	7,330/2,160 *(813/813)*
Recreational Hot Spot (Surface Soils Near Residences)	19,000/3,200 *(19,000/3,600)*	1,420/1,420 *(455/455)*
Commercial Hot Spot Area (Surface Soils within Commercial Area)	410,000/85,000 *(410,000/44,000)*	24,700/6,700 *(1,050/1,050)*

The total Aroclor "hot spot" RME concentrations presented in the preceding table do not differ significantly (if at all) from the EPCs presented in Table 6-17 and evaluated in the quantitative risk assessment. In contrast, the lead concentrations in the "hot spot" locations are roughly an order of magnitude greater than the EPCs presented in Table 6-17. The EPCs for the "hot spot" areas are average reported lead concentrations for the recreational hot spot (both RME and CTE) and trespasser and commercial hot spots for the CTE. For the trespasser and commercial hot spots, the maximum reported concentration was used for the RME case because of the small number of samples in the data set. As detailed in Section 6.4.7 and 6.7.4.3, the EPA IEUBK model and the slope-factor approach model developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996b) were used to evaluate the "hot spot" concentrations in the soils. The results of the analysis are included in Appendix F-12 and indicate that blood lead levels in the

receptors evaluated would exceed the established level of concern of 10 µg/dL. For example, the IEUBK model estimates that 66.9 percent of children are expected to have blood-lead level greater than 10 µg/dL when exposed to lead soil concentrations of 1,420 mg/kg (recreational hot spot) under residential land exposure conditions. Under the RME scenario, the EPA Technical Review Workgroup model predicts that the 95th percentile blood lead concentration among fetuses born to women (e.g., commercial workers) having site exposure to lead concentrations of 24,700 mg/kg (commercial hot spot) would range from 73.22 to 95.87 µg/dL. Under the commercial hot spot CTE scenario, fetal blood lead concentrations would range from 13.41 µg/dL to 18.8 µg/dL. Under the trespasser hot spot RME scenario, the EPA Technical Review Workgroup model predicts that the 95th percentile blood lead concentration among fetuses born to women having site exposure to lead concentrations of 7,330 mg/kg (trespasser hot spot) would range from 15.89 to 22.0 µg/dL. Under the CTE scenario, fetal blood lead concentrations would range from 5.77 µg/dL to 8.96 µg/dL.

6.7.4.5 Asbestos

Asbestos was detected in 178 of 363 solid matrix samples collected in the 0 to 15 foot depth interval at a concentration range of 0.99 to 85 percent. The average concentration was six percent. Although quantitative risk estimates (inhalation risk estimates) cannot be developed for this parameter, it should be noted that asbestos-containing material is material containing more than one percent asbestos (Appendix A to Subpart M of 40 CFR61). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

6.7.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 6.6. Site-specific uncertainties for Area A-1 are presented in the following narrative.

- The PCB congener data set available for study Area A-1 (Table 6-12) is a source of uncertainty in this baseline risk assessment. Specifically, only one sediment sample (OU3-A1-SD03-0002) collected from Area A-1 was analyzed for the PCB congeners and, consequently, the available PCB congener data may not be representative of the concentrations of dioxin-like and non-dioxin-like PCB congeners in the environmental media. Consequently, a cursory risk evaluation of the PCB congener data is presented in this uncertainty section and detailed in Appendix F-13. The maximum concentrations of dioxin-like and non-dioxin-like PCB congeners in the sediment sample was 0.031 µg/kg (in terms of dioxin toxic equivalents) and 2,430 µg/kg, respectively. Assuming that a commercial worker is exposed (via ingestion and dermal contact) to the sediments, cancer risk estimates for the dioxin-like and non-dioxin-like PCB congeners were 1.9E-06 and 2.9E-06, respectively. As noted previously, only one sediment sample was analyzed for the PCB congeners. Consequently, the sample cannot be considered representative of site conditions.

- Copper concentrations exceeded COPC screening criteria in Area A-1 soils/sediments; however due to the lack of a verifiable toxicity value, no quantitative estimate of risks can be performed. Copper is a significant contaminant in Raymark waste. It is reported in Area A-1 soils/sediments (0 to 15 feet bgs) at concentrations ranging from 2.1 mg/kg to 97,000 mg/kg. The maximum concentration exceeds the EPA Region III residential and industrial soil ingestion risk-based concentrations of 3,100 mg/kg and 82,000 mg/kg, respectively. The absence of a quantitative risk evaluation of copper may result in an underestimate of total non-cancer risks.

- Several inorganic COPCs for Area A-1 were detected at concentrations that are less than twice their background concentrations. Manganese was detected at concentrations between 14.6 and 934 mg/kg, versus its background concentration of 660 mg/kg. The background concentration for vanadium is 81.9 mg/kg; the metal was detected at concentrations ranging from 1.1 to 143 mg/kg in site soil samples.

6.7.6 Summary of Human Health Risk Assessment

This section and Table 6-19 present a summary of major risk assessment findings for Area A-1. Three potential receptor groups were evaluated: frequent recreational user, trespasser, and commercial worker.

- Except for the frequent child recreational user under the RME scenario, all hazard indices are less than unity, indicating that adverse noncarcinogenic health effects are not anticipated under the conditions established in the exposure assessment.

- The hazard index for the frequent child recreational user under the RME scenario exceeded unity. However, when HIs are calculated on a target organ/endpoint specific basis, the resulting HIs are less than unity. Therefore, no adverse noncarcinogenic health effects are anticipated for this receptor.

- The risk estimates for current/future commercial workers exposed to surface soils exceed the EPA target cancer risk range (1E-4 to 1E-6) and the CT DEP target risk level of 1E-5 when the RME case is evaluated. The RME risk estimates for the future commercial workers and recreational users are at the high end of the EPA target cancer risk range (1E-4 to 1E-6). RME cancer risks for adolescent trespassers and CTE cancer risks for current/future and future commercial workers, frequent recreational users, and the adolescent trespasser are within the EPA target risk range (1E-4 to 1E-6). RME and CTE cancer risks for commercial workers and the adolescent trespasser and RME cancer risks for recreational users exceed the CT DEP target risk level of 1E-5. Dioxin/furans, PAH compounds (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene), total Aroclors (PCBs), and arsenic are predominant risk drivers.

- Exposure to lead in surface soil by the frequent child recreational user was evaluated using the EPA IEUBK Model and average lead concentrations. The estimated geometric mean blood-lead level for children exposed to lead in site soil

was less than the established level of concern (10 µg/dL). However, the IEUBK model estimates that the percentage of children expected to have blood-lead levels greater than 10 µg/dL exceeds the acceptable level of 5 percent.

- Exposures to lead in surface soil by the frequent adult recreational user and by the commercial worker were evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996b) and average lead concentrations. Under the frequent adult recreational user scenario, the model estimated that the 95th percentile blood lead concentration among fetuses born to women having site exposures are less than the established level of concern of 10 µg/dL. Under the current and future commercial worker RME scenarios, the model estimated that the 95th percentile blood lead concentration among fetuses born to women having site exceed the established level of concern of 10 µg/dL. Under the current and future commercial worker CTE scenarios, the 95th percentile blood lead concentrations only slightly exceed the established level of concern of 10 µg/dL.

- Further evaluation of lead "hot spots" using average lead concentrations within limited areas indicates that exposures to lead in these more limited locations would result in blood lead levels of significantly greater concern.

- Asbestos was detected in 178 of 363 solid matrix samples collected in the 0 to 15 foot depth interval at a concentration range of 0.99 to 85 percent. The average concentration was 6 percent.

6.8 Baseline Human Health Risk Assessment - Area A-2 – Commercial Properties West of Ferry Creek

This section contains the baseline risk assessment performed for soil exposures at Area A-2, the commercial properties west of Ferry Creek. Section 6.8.1 provides an overview of Area A-2, commercial properties west of Ferry Creek, Section 6.8.2 contains a

discussion of the selection of COPCs, Section 6.8.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 6.8.4 contains the numerical results of the risk assessment, and Section 6.8.5 presents site-specific uncertainties.

6.8.1 Overview of Area A-2, Commercial Properties West Of Ferry Creek

Area A-2, commercial properties west of Ferry Creek encompasses numerous commercial properties and an empty lot. Area A-2 covers approximately 10.3 acres, none of which are wetlands. This area is primarily used for commercial purposes. Further details of Area A-2 land use are presented in Section 6.8.3.1. The nature and extent of the contamination detected in Area A-2 was discussed in Section 4. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, locations of maximum detections, and arithmetic mean) for target analytes detected in the Area A-2 environmental media are also summarized in Tables 6-20 through 6-22.

6.8.2 Data Evaluation

Tables 6-20 and 6-21 present a summary of the COPCs for quantitative risk assessment for Area A-2 surface soils and "all soils" to a depth of 15 bgs, respectively. COPCs were identified based on a comparison of site data to the COPC screening levels defined in Section 6.2. All validated CLP data collected during recent and historical investigations, except soil data collected from depths greater than 15 feet, were used to identify COPCs. Soil data at depths greater than 15 feet were not used because human exposure to soils deeper than 15 feet below ground surface is considered very unlikely. Because of the significant correlation observed between field screening data and validated CLP data for lead and copper, screening data were also used for these chemicals at sample locations where no CLP data are available. An evaluation of groundwater is not part of the scope of work for this human health risk assessment, but will be addressed as part of an area-wide groundwater assessment to be provided as a separate document.

Tables 6-22A and 6-22B compare maximum chemical concentrations detected in the surface soils, wetland material, and sediments data set and the "all soils" respectively, to the groundwater protection benchmarks defined in Section 6.2.1.1 (the Generic SSLs for migration from soil to groundwater and State Pollutant mobility GB criteria). Although groundwater data were not addressed in this risk assessment, the comparison allows for a preliminary evaluation of the potential for chemicals to migrate to groundwater and potentially impact the quality of groundwater. Chemicals in excess of groundwater protection benchmarks, but not in excess of direct exposures criteria are not carried through the quantitative risk assessment (numerical risk estimates are not developed) because they are not considered to be significant contributors to the direct exposure pathways identified for potential human receptors.

A media-specific discussion of COPCs is presented in the following paragraphs.

6.8.2.1 COPCs for Soil/Wetland Material/Sediment

The COPC selection process for soil, wetland material, and sediment is summarized in Tables 6-20 and 6-21. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum site concentrations to risk-based COPC screening levels for residential land use, Generic SSLs for migration from soil to air, State RSRs, and maximum background concentrations (inorganic chemicals only);

- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, bis(2-ethylhexyl)phthalate, and indeno(1,2,3-cd)pyrene),

- Aroclors (1242,1248, 1254, 1262, and 1268),

- Metals (arsenic, barium, chromium, copper, lead, manganese, nickel, thallium, and zinc),

- Dioxins/Furans, and

- Asbestos.

All Aroclors were retained as COPCs because at least one congener was detected at a maximum concentration exceeding COPC screening levels. Benzene and vinyl chloride were not accepted as COPCs due to the low frequency of detection and only a slight exceedance of the selection criteria. Vanadium was not selected as a COPC despite concentrations exceeding the risk-based COPC screening levels for residential land use because vanadium, a noncarcinogen, was detected at a maximum concentration less than EPA Region III RBCs for soils AND less than the maximum background concentration.

Bis(2-ethylhexyl)phthalate, Aroclors (1242 and 1254), nickel, thallium, and zinc were selected as COPCs for the 0 to 15 feet bgs category only. The maximum concentrations of these chemicals in the surface soil samples (from depths of 0 to 2 feet bgs) were either less than the direct exposure COPC screening levels and/or background concentrations or the chemical was not detected in the surface soil samples.

Maximum detections in soil, wetland material, and sediment were also compared to Generic SSLs for migration from soil to groundwater and Connecticut RSRs for pollutant mobility in a GB classified area. Maximum concentrations of the following chemicals exceeded the generic soil pollutant mobility criteria, indicating a potential for these chemicals to migrate to groundwater and potentially impact the quality of groundwater;

- VOCs (1,1,2,2-tetrachloroethane, 1,2-dichloroethene [total], benzene, methylene chloride, trichloroethene, and vinyl chloride),

- SVOCs (carbazole, 2,4-dimethylphenol, 4-methylphenol, bis(2-ethylhexyl)phthalate, dibenzofuran, and n-nitrosodiphenylamine),

- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene),

- Pesticides (dieldrin, gamma-chlordane, 4,4'-DDD, 4,4'-DDT, aldrin, beta-BHC, and delta-BHC), and

- Metals (arsenic, barium, chromium, nickel, and thallium).

Maximum detections in soil, wetland material, and sediment of 1,1,2,2-tetrachloroethane, 1,2-dichloroethene(total), benzene, methylene chloride, trichloroethene, vinyl chloride, 2,4-dimethylphenol, 4-methylphenol, bis(2-ethylhexyl) phthalate, dibenzofuran, n-nitrosodiphenylamine, 4,4'-DDD, 4,4'-DDT, aldrin, beta-BHC, delta-BHC, nickel, and thallium exceeded the groundwater protection benchmarks for the 0 to 15 feet bgs category only. The maximum concentrations of these chemicals in the surface soil samples (from depths of 0 to 2 feet bgs) were either less than the Generic SSLs for migration from soil to groundwater and Connecticut RSRs for pollutant mobility in a GB classified area or the chemicals were not detected in the surface soil samples.

6.8.3 Area A-2, Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at Area A-2 and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 6.4. Site-specific information regarding exposure is provided in this section.

The potential for exposure at Area A-2 is based on several factors, including current and future land uses, activity patterns, site access controls, chemical behavior in the environment, and the presence of human receptors. Based on these variables, exposure scenarios were developed to characterize the potential for human exposure under both

current and future site conditions. The future scenario accounts for likely or anticipated changes in land use and site characteristics that may alter exposure and/or concentrations of COPCs in a given medium.

The exposure assessment is based on the assumptions that, in general, chemical compositions for environmental media are identical under current and future site conditions. Under current conditions, potential human receptors (the trespasser and commercial worker) are assumed to be exposed to surface soil (0 to 2 feet bgs) not covered by pavement. In the future contaminated soils currently located at depth and/or beneath pavement to a maximum depth of 15 feet bgs may be brought to the surface during land development (excavation/construction). Under future conditions, commercial workers are evaluated for exposure to soils collected from depths of 0 to 15 feet bgs throughout Area A-2. With the exception of the receptors involved in commercial activities, similar soil exposure is likely for potential receptors under future conditions.

A summary of the potentially significant exposures identified for quantitative evaluation for Area A-2 is provided in Table 6-23.

6.8.3.1 Area A-2, Land Use and Site Access

Area A-2, Commercial properties west of Ferry Creek, is approximately 50 feet east of Area A-1, as shown in Figure 1-2. It encompasses numerous commercial properties that EPA refers to as the Blue Goose Restaurant, Rotary Ski Shop, Fordham Realty, Dan Perkins Subaru, Veras Motors, Ink Masters Shop, and an empty lot at 170 Ferry Boulevard. Area A-2 covers approximately 10.3 acres, none of which are wetlands. This area is primarily used for commercial purposes. Although fence restrictions are located around portions of the commercial properties, access to the commercial properties is still possible. In addition, fencing may not limit access under future land use conditions.

Area A-2 is bounded by Ferry Boulevard to the west, Ferry Creek and an undeveloped lot to the east, residential properties along Willow Avenue to the north, and Broad Street to the south.

6.8.3.2 Area A-2, Potential Receptors

As identified in Section 6.4, several potential receptor populations were initially considered for inclusion in the exposure assessment. However, the majority of these receptors were eliminated from further evaluation based on the current land use, site access, COPCs, and the likelihood of exposure. Of the receptors initially considered (residents, recreational users, commercial workers, construction workers, and trespassers), the receptors retained for quantitative evaluation are commercial workers and trespassers.

Area A-2 is primarily used for commercial purposes, however, adolescent trespassers may trespass onto the site. All areas of Area A-2 are assumed to be accessible to adolescent trespassers.

Possible exposures of commercial workers to site-related contaminants would be through commercial/industrial activities in Area A-2. No major construction projects are planned for Area A-2 or the surrounding areas. However, the baseline risk assessment was conducted assuming that the commercial worker may be exposed to soils as deep as 15 feet bgs in the future.

Future on-site residents were not included in the baseline risk assessment for Area A-2. Current land use suggests that the area is valuable as commercial property. In addition, groundwater at the site is not used or expected to be used in the future as a potable water supply because of brackish conditions.

6.8.3.2.1 Adolescent Trespassers

All areas of Area A-2 are accessible to adolescent trespassers (ages nine to 18). These trespassers are evaluated for exposure to surficial (0 to 2 feet bgs) soils in all of Area A-2. These receptors are assumed to ingest an average of 50 mg/day for five years for the CTE and 100 mg/day for 10 years for the RME. Trespassing is assumed to occur at a frequency of 1 day/week throughout the year. Face, hands, forearms, and lower legs are expected to be available for dermal contact.

6.8.3.2.2 Commercial Workers

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact. Under the current land use, commercial workers are evaluated for exposure to currently exposed surficial soils (0 to 2 feet bgs) throughout Area A-2. In the future contaminated soils currently located at depth and/or beneath pavement may be brought to the surface through excavation and land development. Commercial workers are evaluated for exposure to soils at 0 to 15 feet bgs throughout Area A-2 under future land use. Commercial workers are assumed to be exposed to site media 250 days/year. These receptors are assumed to ingest an average of 50 mg/day for nine years for the CTE and 100 mg/day for 25 years for the RME. Hands, forearms, and lower legs are expected to be available for dermal contact.

6.8.3.3 Area A-2, Exposure Pathways

The primary routes of exposure for potential human receptors at Area A-2 are incidental ingestion of and dermal contact with soil. Exposure routes associated with soil contact are evaluated for trespassers and commercial workers. Other potential exposure routes such as groundwater uses, inhalation of fugitive dust and volatile emissions, were not considered for the following reasons:

- The shallow aquifer at Area A-2 is not used as a potable water supply either at Area A-2 or in the surrounding areas. Shallow groundwater at the site discharges to Ferry Creek and its tributaries. Thus, domestic groundwater exposures by nearby residents are eliminated. In addition, as previously mentioned, groundwater at the site is not used or expected to be used in the future as a potable water supply because of brackish conditions and productivity constraints. It should be noted that groundwater quality at Ferry Creek is being investigated as a separate operable unit.

- Potential exposure to volatile emissions and fugitive dust from Area A-2 is considered to be minimal, thereby eliminating the need for quantitative evaluation of this exposure pathway. As shown in Tables 6-20 and 6-21, all reported surface and subsurface soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a) with the exception of benzene and vinyl chloride. Benzene and vinyl chloride were not accepted as COPCs due to a low frequency of detection and only slight exceedances of the selection criteria.

6.8.3.4 Area A-2, Exposure Point Concentrations

Current EPA risk assessment guidance (EPA, 1992a and 1993d) was used to identify appropriate exposure point concentrations for CTE and RME conditions. Exposure point concentrations used in the risk assessment are presented in Table 6-24. For soil, 95 percent UCLs of the arithmetic mean were used as exposure point concentrations in estimating chemical intakes for the RME and CTE. In data sets with 10 samples or less and data sets in which the calculated 95 percent UCL exceeded the maximum detected concentration, the maximum detected concentration was used as the exposure point concentration for the RME and the average concentration was used for the CTE case. Listings of sample locations included in the evaluation of each receptor group are included in Appendix F-5. Support documentation for the calculation of dioxin TEQ concentrations, 95 percent UCLs, and distributions of data sets for COPCs are presented in Appendix F-6.

6.8.3.5 Area A-2, Estimates of Chemical Intake

Estimates of chemical intake were calculated using equations presented in Section 6.4. Table 6-10 contains the various assumptions used as input parameters to determine chemical intakes for each potential receptor and exposure route. Chemical intake estimates for Area A-2 are provided in the site-specific risk assessment spreadsheets contained in Appendix F-10.

6.8.4 Risk Characterization

A summary of the quantitative risk assessment for Area A-2, the commercial properties west of Ferry Creek, is provided in this section. Total noncarcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk for the RME and CTE scenarios, are summarized in Table 6-25 for the adolescent trespasser and the commercial worker. Sample calculations are provided in Appendix F-8. Appendix F-10 also contains the chemical specific risk for Area A-2.

6.8.4.1 Noncarcinogenic Risks

Hazard indices developed for the commercial/industrial worker and the adolescent trespasser were as follows:

	RME Case	CTE Case
Commercial Worker (Current/Future) (Surface Soils)	1.3E-01	4.0E-02
Commercial Worker (Future) (All Soils - 0 to 15 ft.)	1.5E-01	6.7E-02
Adolescent Trespasser (Current/Future) (Surface Soils)	3.7E-02	1.1E-02

All hazard indices (HI) are less than unity, indicating that adverse noncarcinogenic health effects are not anticipated under the conditions established in the exposure assessment.

6.8.4.2 Carcinogenic Risks

Incremental cancer risk estimates developed for the commercial worker and the adolescent trespasser were as follows:

	RME Case	CTE Case
Commercial Worker (Current/Future) (Surface Soils)	2.0E-04	9.3E-06
Commercial Worker (Future) (All Soils - 0 to 15 ft.)	2.0E-04	2.7E-05
Adolescent Trespasser (Current/Future) (Surface Soils)	2.0E-05	1.4E-06

The risk estimates for the commercial worker are at the high end of the EPA target cancer risk range (1E-4 to 1E-6) when the RME case is evaluated. Cancer risks for the adolescent trespasser are within the EPA target risk range. Risk estimates for the commercial worker for the CTE case are within the EPA target cancer risk range (1E-4 to 1E-6). RME cancer risk estimates for all receptors and CTE cancer risk estimates for future commercial workers exceed 1E-5, the CT DEP target cancer risk level. As detailed on Table 6-25, dioxin/furans, PAH compounds (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene), total Aroclors (PCBs), and arsenic are predominant risk drivers. The cancer risk estimate for dioxins/furans in "all soil" exceeds 1E-4 when the future commercial worker (RME case) is evaluated.

6.8.4.3 Exposure to Lead

Lead was identified as a COPC in soils at the commercial properties west of Ferry Creek. Lead was detected at a maximum concentration of 24,000 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996b). The exposure point concentration of 726 mg/kg for surface soil under the current scenario and 1,400 mg/kg for all soil under the future scenario (based on average lead

concentrations) as well as several default parameters were used to estimate blood-lead levels for workers in a commercial setting. Under the current scenario the model estimated that the 95th percentile blood lead concentration among fetuses born to women having site exposures ranged from 9.67 µg/dL to 13.99 µg/dL for the RME case and from 6.85 µg/dL to 10.35 µg/dL for the CTE case. Under the future scenario the 95th percentile blood lead concentration ranged from 14.92 µg/dL to 20.75 µg/dL, for the RME case and from 9.47 µg/dL to 13.73 µg/dL from the CTE case. Both current and future commercial worker scenarios exceed the established level of concern of 10 µg/dL for the RME case. The CTE case for future commercial workers also exceeds the level of concern. The high end of the range of fetal blood lead concentrations predicted under the CTE current commercial scenario slightly exceeds the level of concern.

6.8.4.4 Summary of "Hot Spot" Analysis of PCB and Lead Results Area A-2

Given the fact that Area A-2 covers approximately 10.3 acres, the data for two of the predominant COCs (lead and total Aroclors) were reviewed with the EPA to determine if contaminant "hot spots" exist within the study area. One potential "hot spot" area was identified as shown in Figure 6-1. A sample list for the Area A-2 hot spot is included in Appendix F-5. The EPCs for total Aroclors and lead in the "hot spot" are presented in the following table and compared to the EPCs presented in Table 6-24 (the EPCs from Table 6-24 are presented in *italics*):

Exposure Area	Total Aroclors (µg/kg) RME/CTE	Lead EPC Concentration (mg/kg)
Hot Spot Area	48,000/15,000 *(48,000/11,000)*	2,100 *(726)*

- The total Aroclor "hot spot" concentrations presented in the preceding table do not differ significantly from the EPCs presented in Table 6-24 and evaluated in the

quantitative risk assessment. In contrast, the lead concentration in the "hot spot" area was roughly three times the EPC presented in Table 6-24. The EPC for the "hot spot" area represents the average lead concentration. As detailed in Section 6.4.7 and 6.8.4.3, the slope-factor approach model developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996b) was used to evaluate the "hot spot" concentrations in the soils. The results of the analysis are included in Appendix F-12 and indicate that blood lead levels for receptors of concern exceed the established level of concern of 10 µg/L. The EPA Technical Review Workgroup model predicts that the 95th percentile blood lead concentration among fetuses born to women (e.g., commercial workers) having site exposure to lead concentrations of 2,100 mg/kg would range from 9.91 to 14.29 µg/dL under the RME scenario and from 6.96 to 10.5 µg/dL under the CTE scenario.

6.8.4.5 Asbestos

Asbestos was detected in 141 of 191 solid matrix samples collected in the 0 to 15 foot interval at a concentration range of 0.99 to 75 percent. The average concentration was five percent. Although quantitative risk estimates (inhalation risk estimates) cannot be developed for this parameter, it should be noted that asbestos-containing material is material containing more than one percent asbestos (Appendix A to Subpart M of 40 CFR 61). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

6.8.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 6.6. Site-specific uncertainties for Area A-2 are presented in the following narrative.

- As detailed in Section 4, several PAHs selected as COPCs were detected at concentrations that are within an order of magnitude of the background concentrations determined for sediments. These include benzo(a)anthracene,

benzo(a)pyrene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Additionally, benzo(b)fluoranthene was detected at a maximum concentration of 11,000 µg/kg, which is below the background concentration of 12,000 µg/kg in sediment.

- Several inorganic COPCs for study Area A-2 were detected at levels that are within two times background concentrations determined for soils in the area. For example, manganese concentrations ranged from 91.7 to 1,050 mg/kg. The maximum background concentration for manganese is 660 mg/kg.

- Copper concentrations exceeded COPC screening criteria in Area A-2 soils; however due to the lack of a verifiable toxicity value, no quantitative estimate of risks can be performed. Copper is a significant contaminant in Raymark waste. It is reported in Area A-2 soils (0 to 15 feet bgs) at concentrations ranging from 17.4 mg/kg to 40,000 mg/kg. The maximum concentration exceeds the EPA Region III residential soil ingestion risk-based concentration of 3,100 mg/kg. The absence of a quantitative risk evaluation of copper may result in an underestimate of total non-cancer risks.

6.8.6 Summary of Human Health Risk Assessment

This section and Table 6-26 present a summary of major risk assessment findings for Area A-2. Two potential receptor groups were evaluated: trespasser and commercial worker.

- All hazard indices are less than unity, indicating that adverse noncarcinogenic health effects are not anticipated under the conditions established in the exposure assessment.

- The risk estimates for the commercial worker are at the high end of the EPA target cancer risk range (1E-4 to 1E-6) when the RME case is evaluated. Risk estimates are within the EPA target cancer risk range but exceed 1E-5, the CT DEP target cancer risk level, for the adolescent trespasser (RME case) and the future commercial worker (CTE case). Dioxin/furans, PAH compounds (benzo(a)pyrene,

benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene), total Aroclors (PCBs), and arsenic are predominant risk drivers.

- Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996b) and the average lead concentration. The results of the slope-factor approach indicate that adverse effects may occur for fetuses of pregnant workers exposed to lead in soil at Area A-2.

- Asbestos was detected in 141 of 191 solid matrix samples collected in the 0 to 15 foot depth interval at a concentration range of 0.99 to 75 percent. The average concentration was 5 percent.

6.9 Baseline Human Health Risk Assessment - Area A-3, Ferry Creek and Properties East of Ferry Creek

This section contains the baseline risk assessment performed for soil exposures at Area A-3, Ferry Creek and properties east of Ferry Creek. Section 6.9.1 provides an overview of Area A-3, Section 6.9.2 contains a discussion of the selection of COPCs, Section 6.9.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 6.9.4 contains the numerical results of the risk assessment, and Section 6.9.5 presents site-specific uncertainties.

6.9.1 Overview of Area A-3, Ferry Creek and Properties East of Ferry Creek

Area A-3, Ferry Creek and properties east of Ferry Creek includes undeveloped wetlands, with Ferry Creek flowing south along the western border. Area A-3 covers approximately 7.1 acres, including wetlands. A more detailed description of Area A-3 is provided in Section 6.9.3.1. The nature and extent of the contamination detected in Area A-3 was discussed in Section 4. Descriptive statistics (frequency of detection, range of positive

detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in the Area A-3 environmental media are also summarized in Tables 6-27 through 6-30.

6.9.2 Data Evaluation

Tables 6-27, 6-28, and 6-30 present a summary of the COPCs for quantitative risk assessment for Area A-3 surface soils/wetland materials/sediments, "all soils" to a depth of 15 bgs, and surface waters, respectively. COPCs were identified based on a comparison of site data to the COPC screening levels defined in Section 6.2. All validated CLP data collected during recent and historical investigations, except soil data collected from depths greater than 15 feet, were used to identify COPCs. Soil data at depths greater than 15 feet were not used because human exposure to soils deeper than 15 feet below ground surface is considered very unlikely. Because of the significant correlation observed between field screening data and validated CLP data for lead and copper, screening data were also used for these chemicals at sample locations where no CLP data are available. An evaluation of groundwater is not part of the scope of work for this human health risk assessment, but will be addressed as part of an area-wide groundwater assessment to be provided as a separate document.

Table 6-29A and 6-29B compare maximum chemical concentrations detected in the surface soils/sediments/wetland materials data set and the "all soils" data set, respectively, to the groundwater protection benchmarks defined in Section 6.2.1.1 (the Generic SSLs for migration from soil to groundwater and State Pollutant mobility GB criteria). Although groundwater data were not addressed in this risk assessment, the comparison allows for a preliminary evaluation of the potential for chemicals to migrate to groundwater and potentially impact the quality of groundwater. Chemicals in excess of groundwater protection benchmarks, but not in excess of direct exposures criteria are not carried through the quantitative risk assessment (numerical risk estimates are not developed) because they are not considered to be significant contributors to the direct exposure pathways identified for potential human receptors.

A media-specific discussion of COPCs is presented in the following paragraphs.

6.9.2.1 COPCs for Soil/Wetland Material/Sediment

The COPC selection process for soil, wetland material, and sediment is summarized in Tables 6-27 and 6-28. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum site concentrations to risk-based COPC screening levels for residential land use, Generic SSLs for migration from soil to air, State RSRs, and maximum background concentrations (inorganic chemicals only);

- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene),
- SVOCs (bis(2-ethylhexyl)phthalate),
- Pesticides (4,4'-DDT and dieldrin),
- Aroclors (1248, 1254, 1260, 1262, and 1268),
- PCB congeners (2,2',3,3',4,4',5-heptachlorobiphenyl, decachlorobiphenyl, total heptachlorobiphenyls, total hexachlorobiphenyls, total nonachlorobiphenyls, total octachlorobiphenyls, total pentachlorobiphenyls, total tetrachlorobiphenyls, and total trichlorobiphenyls),
- Metals (antimony, arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, thallium, vanadium, and zinc),
- Dioxins/Furans, and
- Asbestos.

Aluminum was not selected as a COPC because EPA Region I does not advocate quantitative risk assessment of this metal and because aluminum is not a significant, site-related contaminant. N-nitroso-di-n-propylamine was not accepted as a COPC due to the low frequency of detection and only a slight exceedance of the selection criteria. However, all Aroclors and PCB congeners were accepted as COPCs because at least one congener was detected at a maximum concentration exceeding COPC screening levels.

Benzo(k)fluoranthene was selected as a COPC for the 0 to 15 feet bgs category only since the maximum concentration of this chemical in the surface soil samples (from depths of 0 to 2 feet bgs) was less than the direct exposure screening levels.

Maximum detections in soil, wetland material, and sediment were also compared to Generic SSLs for migration from soil to groundwater and Connecticut RSRs for pollutant mobility in a GB classified area. Maximum concentrations of the following chemicals exceeded the generic soil pollutant mobility criteria, indicating a potential for these chemicals to migrate to groundwater and potentially impact the quality of groundwater;

- VOCs (1,1,2,2-tetrachloroethane),
- SVOCs (bis(2-ethylhexyl)phthalate, carbazole, 2,4-dimethylphenol, n-nitroso-di-n-propylamine, n-nitrosodiphenylamine, and pentachlorophenol),
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene),
- Pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, alpha-BHC, alpha-chlordane, beta-BHC, delta-BHC, dieldrin, gamma-BHC, and gamma-chlordane), and
- Metals (antimony, barium, cadmium, chromium, mercury, nickel, and thallium).

Maximum detections in soil, wetland material, and sediment of 2,4-dimethylphenol exceeded the groundwater benchmarks for the 0 to 15 feet bgs category only since the maximum concentrations of these chemicals in the surface soil samples (from depths of 0 to 2 feet bgs) were less than the Generic SSLs for migration from soil to groundwater and Connecticut RSRs for pollutant mobility in a GB classified area.

Under the Connecticut RSR guidance (CT DEP, January 1996), concerns regarding the mobility of inorganics are addressed using TCLP and/or SPLP data. A comparison of site-specific TCLP data to State RSRs for pollutant mobility and TCLP criteria is provided in Table 6-29C. Reported concentrations of lead in the TCLP extract from one soil sample exceeded the State pollutant mobility criteria.

6.9.2.2 COPCs for Surface Water

Table 6-30 presents a summary of the COPC selection process for surface water. The following chemicals were identified as COPCs based on a comparison of maximum site concentrations to risk-based COPC screening levels for tap water use and drinking water standards (federal and state MCLs);

- VOCs (1,1,1-trichloroethane, 1,1-dichloroethene, 1,2-dichloroethene(total), benzene, chlorobenzene, trichloroethene, and vinyl chloride),
- Aroclor 1262, and
- Metals (antimony, arsenic , chromium, copper, lead, manganese, and mercury).

Although surface water at the site is not currently used or expected to be used in the future as a drinking water supply, drinking water criteria (federal and state MCLs) were included for informational purposes and to conservatively identify COPCs for the site. Aluminum and iron were not selected as COPCs, despite concentrations above the risk-

based COPC screening levels and/or federal MCLs. EPA Region I does not advocate quantitative risk assessment of the health effects of these metals due to the lack of adequate toxicity criteria. The Connecticut State MCL for sodium is a state notification level and is not risk based. For this reason, sodium was not selected as a COPC, despite concentrations exceeding the state MCL.

6.9.3 Area A-3, Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at Area A-3 and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 6.4. Site-specific information regarding exposure is provided in this section.

The potential for exposure at Area A-3 is based on several factors, including current and future land uses, activity patterns, site access controls, chemical behavior in the environment, and the presence of human receptors. Based on these variables, exposure scenarios were developed to characterize the potential for human exposure under both current and future site conditions. The future scenario accounts for likely or anticipated changes in land use and site characteristics that may alter exposure and/or concentrations of COPCs in a given medium.

The exposure assessment is based on the assumptions that, in general, chemical compositions for environmental media are identical under current and future site conditions. Under current conditions, potential human receptors (the frequent recreational user) are assumed to be exposed to surface soil and/or sediment (0 to 2 feet bgs). Similar soil/sediment exposure is likely for potential receptors under future conditions. Given that future changes to the chemical composition of the creek/marshy waters are difficult to predict, it is assumed for the purposes of this risk assessment that chemical concentrations in surface water would not change in the future.

A summary of the potentially significant exposures identified for quantitative evaluation for Area A-3 is provided in Table 6-31.

6.9.3.1 Area A-3, Land Use and Site Access

Area A-3, Ferry Creek and properties east of Ferry Creek, runs parallel to Housatonic Avenue, as shown in Figure 1-2. It includes undeveloped wetlands, with Ferry Creek flowing south along the western border. A flood control barrier/hydraulic sluice gate system is located to the south where Ferry Creek and Broad Street intersect. Area A-3 covers approximately 7.1 acres, including approximately 2.4 acres of wetlands (including the creek channel).

Area A-3 is bounded by Area A-2 to the west, residential properties along Housatonic Avenue to the east, residential properties along Willow Avenue to the north, and Broad Street to the south.

6.9.3.2 Area A-3, Potential Receptors

As identified in Section 6.4, several potential receptor populations were initially considered for inclusion in the exposure assessment. However, the majority of these receptors were eliminated from further evaluation based on the current land use, site access, COPCs, and the likelihood of exposure. Of the receptors initially considered (residents, recreational users, commercial workers, construction workers, and trespassers), the receptors retained for quantitative evaluation are frequent recreational users. As discussed in Section 6.4, the frequent recreational user is evaluated to estimate risks to individuals residing in close proximity to the Area A-3 site contamination.

Possible exposures of nearby residents to site-related contaminants would be through recreational activities. Persons involved in recreational activities (the frequent recreational user) may visit the site, thereby coming in contact with potentially contaminated site media.

Future on-site residents were not included in the baseline risk assessment for Area A-3. Much of the soil in Area A-3 surrounding Ferry Creek is wetland material and local construction practices preclude subsurface excavation and/or development of Area A-3 for residential purposes. In addition, groundwater at the site is not used or expected to be used in the future as a potable water supply because of brackish conditions.

6.9.3.2.1 Recreational Users

Area A-3, Ferry Creek and properties east of Ferry Creek, is located near residences and may be used for recreation by nearby residents. These frequent recreational users are evaluated for exposure to surficial soils, wetland soils, and sediments (0 to 2 feet bgs) in all of Area A-3 under current and future land use. The unattractive and intermittent nature of the creek in this area precludes swimming in the creek. Therefore, direct but limited contact with surface water in the creek is anticipated for these receptors. The unattractive nature of the creek also precludes visits by very young children, therefore the child recreational user is presumed to be a three to six year old. Recreational users are assumed to be exposed to surface water one hour/day. Recreational users are assumed to be exposed to site media frequently due to the proximity of residential properties. However, due to the wet nature of Area A-3, recreational exposures are assumed to occur at a frequency of 90 days/year. This value assumes exposures occur three days/week during the months of April through October. These receptors are assumed to ingest an average of 200 mg/day for three years for the child and 100 mg/day for 24 years for the adult for the RME, and an average of 100 mg/day for three years for the child and 50 mg/day for seven years for the adult for the CTE. Face, hands, forearms, and lower legs are expected to be available for dermal contact with soils/wetland soils/ sediments for adults. For children, face, hands, forearms, lower legs, and feet are expected to be available for dermal contact with soils/wetland soils/ sediments. Hands, lower legs, and feet are expected to be available for dermal contact with surface waters.

6.9.3.3 Area A-3, Exposure Pathways

The primary routes of exposure for potential human receptors at Area A-3 are incidental ingestion of and dermal contact with soil, sediment, and wetland soils, and dermal contact with surface water. Exposure routes associated with soil, sediment, wetland soils, and surface water contact are evaluated for recreational users.

Other potential exposure routes such as groundwater uses, inhalation of fugitive dust and volatile emissions, and ingestion of surface water were not considered for the following reasons:

- The shallow aquifer at Area A-3 is not used as a potable water supply either at Area A-3 or in the surrounding areas. Shallow groundwater at the site discharges to Ferry Creek and its tributaries. Thus, domestic groundwater exposures by nearby residents are eliminated. In addition, as previously mentioned, groundwater at the site is not used or expected to be used in the future as a potable water supply because of brackish conditions and productivity constraints. It should be noted that groundwater quality at Ferry Creek is being investigated as a separate operable unit.

- Potential exposure to volatile emissions and fugitive dust from Area A-3 is considered to be minimal, thereby eliminating the need for quantitative evaluation of this exposure pathway. As shown in Tables 6-27 and 6-28, all reported surface and subsurface soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a) with the exception of chromium. However, the SSL_{AIR} for chromium assumes that chromium is present in the hexavalent state. The assumption that all chromium is in the hexavalent state is overly conservative. Additionally, the average chromium concentration detected in the solid matrix samples (110 mg/kg) is less than the SSL_{AIR} (270 mg/kg).

- Potential exposure to contaminants in surface water from Area A-3 through incidental ingestion is considered to be minimal due to the limited nature of contact with surface water in this area.

6.9.3.4 Area A-3, Exposure Point Concentrations

Current EPA risk assessment guidance (EPA, 1992a and 1993d) was used to identify appropriate exposure point concentrations for CTE and RME conditions. Exposure point concentrations used in the risk assessment are presented in Table 6-32. For wetland soil, soil, sediment, and surface water, 95 percent UCLs of the arithmetic mean were used as exposure point concentrations in estimating chemical intakes for the RME and CTE. In data sets with 10 samples or less and data sets in which the calculated 95 percent UCL exceeded the maximum detected concentration, the maximum detected concentration was used as the exposure point concentration for the RME and the average concentration was used for the CTE case. A listing of sample locations included in the evaluation of Area A-3 receptors is included in Appendix F-5. No subsets of data were identified for use in evaluating exposures to receptors in Area A-3. Support documentation for the calculation of dioxin TEQ concentrations, 95 percent UCLs, and distributions of data sets for COPCs are presented in Appendix F-6.

6.9.3.5 Area A-3, Estimates of Chemical Intake

Estimates of chemical intake were calculated using equations presented in Section 6.4. Tables 6-10 and 6-11 contain the various assumptions used as input parameters to determine chemical intakes for each potential receptor and exposure route. Chemical intake estimates for Area A-3 are provided in the site-specific risk assessment spreadsheets contained in Appendix F-11.

6.9.4 Risk Characterization

A summary of the quantitative risk assessment for Area A-3, Ferry Creek and properties east of Ferry Creek, is provided in this section. Total noncarcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk for the RME and CTE scenarios, are summarized in Table 6-33 for the frequent adult and child recreational user. Sample calculations are provided in Appendix F-8. Appendix F-11 contains the chemical specific risk for Area A-3.

6.9.4.1 Noncarcinogenic Risks

Hazard indices developed for the frequent adult and child recreational user exposed to surface soils, sediments, and wetland soils and to surface waters in the wetlands and creeks were as follows:

	RME Case	CTE Case
Frequent Recreational User Adult (Current/Future)(Surface Materials/ Surface Water)	2.4E-01	8.4E-02
Frequent Recreational User Child (Current/Future)(Surface Materials/Surface Water)	1.2E+00	5.2E-01

Hazard Indices (HI) developed for the child recreational user for the RME case exceed unity. Examination of target organ-specific hazard indices for the frequent child recreational user under RME scenario reveals that none are at or greater than unity. Therefore, no adverse noncarcinogenic health effects are expected under the conditions established in the exposure assessment.

6.9.4.2 Carcinogenic Risks

Incremental cancer risk estimates developed for the frequent adult and child recreational user exposed to surface soils, sediments, and wetland materials and to surface waters in the wetlands and creeks were as follows:

	RME Case	CTE Case
Frequent Recreational User Adult[1] (Current/Future)(Surface Materials/Surface Water)	1.0E-04	1.2E-05
Frequent Recreational User Child (Current/Future)(Surface Materials/Surface Water)	8.3E-05	3.1E-05

(1) Summation of total risk for frequent recreational user (adult plus child): 1.8E-04 (RME case) and 4.3E-05 (CTE case).

The combined risk estimates for the child and adult RME receptors are at the high end of the EPA target cancer risk range (1E-4 to 1E-6). The risk estimates for the CTE receptors are within the EPA target cancer risk range. Risk estimates for the RME and CTE cases exceed 1E-5, the CT DEP target cancer risk level. As summarized in Table 6-33, the majority of the risk is attributable to exposures to COPCs in soils/sediments/wetland materials. Risk estimates for adult recreational exposure to soils/wetland materials/sediments were 8.7E-5 and 8.2E-6 for RME and CTE cases, respectively. Total Aroclors (PCBs), dioxin/furans, PAH compounds (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene), and arsenic in these media are the predominant risk drivers. Cancer risk estimates for these COPCs exceed 1E-5 when the RME case is evaluated. However, it should be noted that risk estimates for the dermal route of exposure (to soils/wetland materials/sediments) for total Aroclors and PAHs exceed those calculated for the ingestion route of exposure. Primary risk drivers in surface water are Aroclor 1262, 1,1-dichloroethene, vinyl chloride, and arsenic.

6.9.4.3 Exposure to Lead

Lead was identified as a COPC in soils, wetland materials, and sediments at Ferry Creek and the properties east of Ferry Creek. Lead was detected at a maximum concentration of 34,500 mg/kg.

Exposure to lead in surface soil by the frequent child recreational user was evaluated using the EPA IEUBK Model, as discussed in Section 6.4.7. The IEUBK model was developed to evaluate exposures to lead by children in a residential setting. Consequently using the IEUBK model for child recreational exposures should provide a very conservative evaluation of exposures to lead. The exposure point concentration of 1,240 mg/kg (based on the average lead concentration) as well as several default parameters were used to estimate blood-lead levels for children in a residential setting. IEUBK Model outputs are included in Appendix F-12. The estimated geometric mean blood-lead level for children exposed to lead in site soil was 11.5 µg/dL, which exceeds the established level of concern of 10 µg/dL. The IEUBK model estimates that 58.3 percent of children are expected to have blood-lead levels greater than 10 µg/dL, which exceeds the acceptable level of 5 percent.

Exposure to lead in surface soil by the frequent adult recreational user was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996b). The exposure point concentration of 1,240 mg/kg for soil as well as several default parameters were used to estimate blood-lead levels for adults engaging in recreational activities. Under the RME scenario the model estimated that the 95th percentile blood lead concentration among fetuses born to women having site exposures ranged from 7.5 µg/dL to 11.19 µg/dL, which slightly exceeds the established level of concern of 10 µg/dL. Under the CTE scenario the 95th percentile blood lead concentration ranged from 5.76 µg/dL to 8.95 µg/dL, which is less than the established level of concern of 10 µg/dL.

6.9.4.4 Asbestos

Asbestos was detected in 73 of 184 solid matrix samples collected in the 0 to 2 foot interval at a concentration range of 0.99 to 90 percent. The average concentration was five percent. Although quantitative risk estimates (inhalation risk estimates) cannot be developed for this parameter, it should be noted that asbestos-containing material is material containing more than one percent asbestos (Appendix A to Support M of 40 CFR 61). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

6.9.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 6.6. Site-specific uncertainties for Area A-3 are presented in the following narrative.

- The PCB congener data set available for study Area A-3 (Table 6-32) is a source of uncertainty in this baseline risk assessment. Specifically, only two sediment samples (OU3-A3-SD05-0002 and OU3-A3-SD05-0204) collected from Area A-3 were analyzed for the PCB congeners and, consequently, the available PCB congener data may not be representative of the concentrations of dioxin-like and non-dioxin-like PCB congeners in the environmental media. Consequently, a limited risk evaluation of the PCB congener data is presented in this uncertainty section and detailed in Appendix F-13. The maximum concentrations of dioxin-like and non-dioxin-like PCB congeners in the sediment samples were 0.092 µg/kg (in terms of dioxin toxic equivalents) and 17,804 µg/kg, respectively. Assuming that a frequent recreational user (adult) is exposed to the sediments, cancer risk estimates for the dioxin-like and non-dioxin-like PCB congeners are 1.7E-06 and 1.5E-05, respectively. As noted previously, only two sediment samples were analyzed for

the PCB congeners. Consequently, the samples cannot be considered representative of site conditions.

- Several PAHs selected as COPCs were detected at concentrations that are within an order of magnitude of the background concentrations determined for sediments. These include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene. Additionally, dibenzo(a,h)anthracene was detected at a maximum concentration of 1,800 µg/kg, which is less than its background concentration of 2,000 µg/kg (data are presented in Section 4.0).

- Of the 16 inorganics that were selected as COPCs, arsenic and vanadium were detected at maximum concentrations that are less than two times the parameter's background concentration (Table 6-28). Arsenic concentrations ranged between 1.7 and 21.2 mg/kg; the maximum background arsenic concentration is 11.6 mg/kg. Vanadium has a background concentration of 81.9 mg/kg and detected concentrations ranged between 6.6 and 157 mg/kg.

- Copper concentrations exceeded COPC screening criteria in Area A-3 soils/sediments; however due to the lack of a verifiable toxicity value, no quantitative estimate of risks can be performed. Copper is a significant contaminant in Raymark waste. It is reported in Area A-3 surface soils/sediments (0 to 2 feet bgs) at concentrations ranging from 16.2 mg/kg to 34,600 mg/kg. The maximum concentration exceeds the EPA Region III residential soil ingestion risk-based concentrations of 3,100 mg/kg. The absence of a quantitative risk evaluation of copper may result in an underestimate of total non-cancer risks.

6.9.6 Summary of Human Health Risk Assessment

This section and Table 6-34 present a summary of major risk assessment findings for Area A-3. One potential receptor group was evaluated: the frequent recreational user.

- HIs developed for the child receptor for the RME case exceed unity. However, when HIs are calculated on a target organ/endpoint-specific basis, the resulting HIs are less than unity. Therefore, no adverse noncarcinogenic effects are anticipated for this receptor under the conditions established in this exposure assessment.

- The combined cancer risk estimates for the child and adult RME scenarios are at the high end of the EPA target cancer risk range (1E-4 to 1E-6). Total Aroclors (PCBs), dioxin/furans, and PAH compounds (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene) are the predominant risk drivers in soils/wetland soils/sediments. Aroclor 1262, 1,1-dichloroethene, vinyl chloride, and arsenic are the primary risk drivers in surface water.

- Exposure to lead in surface soil by the frequent child recreational user was evaluated using the EPA IEUBK Model and average lead concentrations. The IEUBK Model results indicate that adverse effects due to lead exposure are anticipated for the child receptor having direct contact with lead in soil.

- Exposures to lead in surface soil by frequent adult recreational users were evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead. (EPA, December 1996b) and average lead concentrations. Under the adult recreational user scenario the model estimated that the 95th percentile blood lead concentration among fetuses born to women having site exposures slightly exceeds the established level of concern of 10 µg/dL under RME assumptions. Under the CTE case, the model estimated that the 95th percentile fetal blood lead concentration are less than the established level of concern.

- Asbestos was detected in 73 of 184 solid matrix samples collected in the 0 to 2 foot interval at a concentration range of 0.99 to 90 percent. The average concentration was 5 percent.

6.10 Summary of Human Health Risk Assessment for Areas A-1, A-2, and A-3

This section presents a summary of major risk assessment findings for Areas A-1, A-2 and A-3.

6.10.1 Noncarcinogenic Risks

- Except for the frequent child recreational user under the RME scenario, all HIs are less than unity in Area A-1, indicating that adverse noncarcinogenic health effects are not anticipated under the conditions established in the exposure assessment for these receptors. For the frequent child recreational user, the total HI is greater than unity. However, when HIs are calculated on a target organ/endpoint-specific basis, the resulting HIs are less than unity. Therefore, no adverse noncarcinogenic effects are anticipated for any receptor in Area A-1 under the conditions established in the exposure assessment.

- In Area A-2, all HIs were less than unity, indicating that adverse noncarcinogenic health effects are not anticipated for any receptor under the conditions established in the exposure assessment.

- Hazard indices in Area A-3 for the child recreational user for the RME case exceed unity when exposure to soils/wetland materials/sediments is evaluated. The hazard index is less than unity for exposure to surface water (RME case) for this receptor. When HIs are calculated on a target organ/endpoint-specific basis, the resulting HIs are less than unity. Therefore, adverse noncarcinogenic health effects are not anticipated for the recreational child as a result of exposure to soils/wetland materials/sediments and/or surface water.

6.10.2 Carcinogenic Risks

- Cancer risks for commercial workers and frequent adult and child recreational users in Area A-1, exceed or are at the high end of the EPA target risk range of 1E-4 to

1E-6 and exceed the CT DEP target risk level of 1E-5 for the RME case. Cancer risk estimates for adolescent trespassers in Area A-1 are within the EPA target cancer risk range, but exceed the CT DEP target risk level. The primary carcinogenic risk drivers are dioxins/furans, PAHs (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene), total Aroclors (PCBs), and arsenic.

- In Area A-2, the cancer risks for the commercial worker RME scenarios are at the high end of the EPA target cancer risk range (1E-4 to 1E-6). The commercial worker CTE scenarios and the adolescent trespasser RME and CTE scenarios have cancer risks which are within the EPA target risk range. RME cancer risks for all receptors and CTE cancer risks for future commercial workers exceed the CT DEP target risk level of 1E-5. The primary risk drivers are dioxins/furans, PAH compounds (benzo(a)pyrene), total Aroclors (PCBs), and arsenic.

- Carcinogenic risks are at the high end of the EPA target cancer risk range (1E-4 to 1E-6) and exceed the CT DEP target risk level of 1E-5 for the combined adult and child frequent recreational user scenarios in Area A-3 from exposure to soils/wetland soils/sediments and surface water (RME case). The primary risk drivers are dioxins/furans, total Aroclors (PCBs), PAHs (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene), and arsenic in soils/wetland soils/sediments. The risk drivers in surface water are Aroclor 1262, arsenic, vinyl chloride, and 1,1-dichloroethene.

6.10.3 Exposure to Lead

Exposures to lead were evaluated using two models. Exposure to lead in soil by a child was evaluated with the EPA IEUBK Model. The IEUBK Model presents a geometric mean blood lead level for children and estimates the percentage of children expected to have blood-lead levels greater than 10 µg. (The benchmark established by EPA is five percent.) A slope-factor approach developed by the Technical Review Workgroup for Lead (EPA, December 1996b) was used to evaluate adult (and fetal) exposure to lead in soils. The

95th percentile blood lead level for women having site exposures and the 95th percentile blood lead concentration among fetuses born to women having site exposures are estimated with this model.

- Lead was detected at a maximum concentration of 25,600 mg/kg in Area A-1. The exposure point concentrations (average lead concentrations) of 455 mg/kg for surface soil under the recreational child and adult scenarios, 1,050 mg/kg for surface soil under the current commercial worker, and 745 mg/kg in "all soil" for the future commercial worker as well as several default parameters were used to estimate blood-lead levels for receptors. In Area A-1, the estimated geometric mean for children exposed to lead in site soil was less than the established level of concern (10 µg/dL); however, the IEUBK Model estimates that the percentage of children expected to have blood-lead levels greater than 10 µg/dL is 11.3 percent which exceeds the acceptable level of five percent. Under the frequent adult recreational user scenario, the Technical Review Work Group model estimated that the 95th percentile blood lead level is less than the level of concern. The 95th percentile blood lead level among fetuses born to women having site exposure under the current commercial scenario exceeds the level of concern of 10 µg/dL. The 95th percentile blood lead level among fetuses born to women having site exposure under the RME future commercial scenario, exceeds the level of concern of 10 µg/dL.

- In Area A-2, lead was detected at a maximum concentration of 24,000 mg/kg. The exposure point concentration (average lead concentrations) of 726 mg/kg for surface soil under the current scenario and 1,400 mg/kg for "all soil" under the future scenario as well as several default parameters were used to estimate blood-lead levels for workers in a commercial setting. Under the current surface soil exposure scenario and the future "all soil" exposure scenario, the model estimated that the 95th percentile blood lead concentration among fetuses born to women having site exposures exceeds the established level of concern of 10 µg/dL.

- In Area A-3, lead was detected at a maximum concentration of 35,400 mg/kg. The exposure point concentration (an average lead concentration) of 1,240 mg/kg for surface soil, as well as several default parameters, were used to estimate blood-lead levels for the frequent adult and child recreational users. Under the adult RME scenario only, the model estimated that the 95th percentile blood lead concentration among fetuses born to women having site exposures slightly exceeds the established level of concern of 10 µg/dL. In Area A-3, the estimated geometric mean of 11.5 µg/dL for children exposed to lead in site exceeds the established level of concern (10 µg/dL). The IEUBK Model estimates that the percentage of children expected to have blood-lead levels greater than 10 µg/dL is 58.3 percent, which exceeds the acceptable level of five percent.

6.10.4 Exposure to Asbestos

Although quantitative risk estimates (inhalation risk estimates) cannot be developed for asbestos, it should be noted that asbestos-containing material is material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

- In Area A-1, asbestos was detected in 178 of 363 solid matrix samples collected in the 0 to 15-foot depth interval at a concentration range of 0.99 to 85 percent. The average concentration was six percent.

- In Area A-2, asbestos was detected in 141 of 191 solid matrix samples collected in the 0 to 15 foot interval at a concentration range of 0.99 to 75 percent. The average concentration was five percent.

- In Area A-3, asbestos was detected in 73 of 184 solid matrix samples collected in the 0 to 2 foot interval at a concentration range of 0.99 to 90 percent. The average concentration was five percent.